

WHAT IS CLAIMED IS:

- 1 1. An ultra-wideband receiver comprising:
 - 2 a filter coupled to a signal input, the filter to pass signals in a frequency band from a
 - 3 received signal provided by the signal input;
 - 4 an amplifier coupled to the filter, the amplifier to bring the passed signals to a signal level
 - 5 compatible with circuitry in the receiver;
 - 6 a demodulating unit coupled to the amplifier, the demodulating unit containing circuitry
 - 7 to bring the passed signals to an internal frequency;
 - 8 a timing generating unit coupled to the demodulating unit, the timing generating unit
 - 9 containing circuitry to generate samples of the passed signals at different timing offsets; and
 - 10 a converter coupled to the timing generating unit, the converter to convert continuous
 - 11 samples produced by the timing generating unit into discrete samples.
- 1 2. The ultra-wideband receiver of claim 1, wherein the demodulating unit further contains
- 2 circuitry to provide in-phase and quadrature phase signal streams from the passed signals.
- 1 3. The ultra-wideband receiver of claim 2, wherein the demodulating unit further contains
- 2 amplifiers to variably adjust the gain of the in-phase and quadrature phase signal streams.
- 1 4. The ultra-wideband receiver of claim 1, wherein the timing generating unit comprises a
- 2 pair of sample/hold circuits having inputs coupled to the demodulating unit, and wherein a first
- 3 sample/hold circuit produces an on-time sample and a second sample/hold circuit produces an
- 4 early and a late sample.

1 5. The ultra-wideband receiver of claim 4, wherein the demodulating unit provides in-phase
2 and quadrature phase signal streams, and wherein the timing generating unit comprises a pair of
3 sample/hold circuits for each signal stream.

1 6. The ultra-wideband receiver of claim 1, wherein the timing generating unit produces on-
2 time, early, and late samples, and wherein the converter comprises a pair of analog-to-digital
3 converters (ADC), wherein a first ADC converts the on-time samples and a second ADC
4 converts the early and late samples.

1 7. The ultra-wideband receiver of claim 6, wherein the first ADC has a higher resolution
2 than the second ADC.

1 8. The ultra-wideband receiver of claim 1 further comprising an interference mitigating
2 circuit having an input coupled to the amplifier and an output coupled to the demodulator, the
3 interference mitigating circuit comprising:
4 a down-conversion unit to bring an interference band within the received signal down to
5 baseband; and
6 a high-pass filter coupled to the down-conversion unit, the high-pass filter to eliminate
7 the interference band located at baseband.

1 9. The ultra-wideband receiver of claim 8, wherein there is an interferer located within a
2 frequency band of 5.15 GHz to 5.85 GHz, wherein the down-conversion unit is a mixer with a
3 carrier frequency of approximately 5.5 GHz, and wherein the high-pass filter has a cutoff
4 frequency at approximately 350 MHz.

- 1 10. The ultra-wideband receiver of claim 1 further comprising a digital baseband circuit, the
2 digital baseband circuit comprising:
- 3 a despreading unit to remove a spreading code applied to a transmitted signal;
4 an adjust timing circuit coupled to the despreading unit, the adjust timing circuit
5 containing circuitry to control sampling of the converter;
6 a multipath processing unit coupled to the despreading unit, the multipath processing unit
7 containing circuitry to combine multiple copies of the transmitted signal in the signals into a
8 single signal; and
9 a decoding unit coupled to the multipath processing unit, the decoding unit containing
10 circuitry to remove encoding present in the single signal.
- 1 11. The ultra-wideband receiver of claim 10, wherein the despreading unit comprises a pair
2 of despreaders, one for an in-phase and one for a quadrature phase signal stream.
- 1 12. The ultra-wideband receiver of claim 10, wherein the despreading unit further provides
2 timing information.
- 1 13. The ultra-wideband receiver of claim 12, wherein the adjust timing circuit uses timing
2 information from the despreading unit to adjust converter sampling.
- 1 14. The ultra-wideband receiver of claim 10 further comprising an automatic gain control
2 (AGC) coupled to the despreading unit, wherein the AGC controls amplifiers to variably adjust
3 the gain of the signal stream.
- 1 15. The ultra-wideband receiver of claim 10, wherein the multipath processing unit
2 comprises:

3 a rake receiver containing a plurality of tracking fingers, each tracking finger to
4 independently track a copy of the transmitted signal;
5 a channel estimation unit coupled to the rake receiver, the channel estimation unit
6 containing circuitry to provide a delay spread profile of the received signal; and
7 a carrier phase tracking unit coupled to the rake receiver, the carrier phase tracking unit
8 containing circuitry to provide phase error information.

1 16. The ultra-wideband receiver of claim 10, wherein the decoding unit implements a Viterbi
2 decoder.

1 17. The ultra-wideband receiver of claim 10 further comprising an equalizer coupled to the
2 multipath processing unit and the decoding unit, the equalizer to help mitigate inter-symbol
3 interference.

1 18. The ultra-wideband receiver of claim 17, wherein the equalizer is an adaptive equalizer.

1 19. The ultra-wideband receiver of claim 17, wherein the equalizer is a non-adaptive
2 equalizer.

- 1 20. An ultra-wideband transmitter comprising:
2 an encoding unit coupled to a data source, the encoding unit containing circuitry to apply
3 a code to data provided by the data source;
4 a spreading unit coupled to the encoding unit, the spreading unit containing circuitry to
5 apply a spreading code to the data;
6 a pulse shaping unit coupled to the spreading unit, the pulse shaping unit containing
7 circuitry to apply mask of a desired pulse with desired frequency characteristics to the encoded
8 and spread data;
9 a modulating unit coupled to the pulse shaping unit, the modulating unit apply a carrier
10 frequency to the shaped, encoded, and spread data; and
11 a filter coupled to the modulating unit, the filter to ensure that the modulated, shaped,
12 encoded, and spread data fit within a desired frequency range.
- 1 21. The ultra-wideband transmitter of claim 20, wherein the encoding unit is a convolutional
2 encoder.
- 1 22. The ultra-wideband transmitter of claim 20, wherein the spreading unit multiplies the
2 data with a spreading code with a specified spreading gain.
- 1 23. The ultra-wideband transmitter of claim 22, wherein the spreading code has a period that
2 is larger than the specified spreading gain.
- 1 24. The ultra-wideband transmitter of claim 23, wherein the period is significantly larger than
2 the specified spreading gain.

27. An ultra-wideband device comprising:

- an antenna to transmit and receive signals;
- a switch coupled to the antenna, the switch to control access to the antenna;
- a receiver coupled to the switch, the receiver comprising
 - a filter coupled to the switch, the filter to pass signals in a frequency band from a received signal provided by the switch;
 - an amplifier coupled to the filter, the amplifier to bring the passed signals to a signal level compatible with circuitry in the receiver;
 - a demodulating unit coupled to the amplifier, the demodulating unit containing circuitry to bring the passed signals to an internal frequency;
 - a timing generating unit coupled to the demodulating unit, the timing generating unit containing circuitry to generate samples of the passed signals at different timing offsets; and
 - a converter coupled to the timing generating unit, the converter to convert continuous samples produced by the timing generating unit into discrete samples;
- the ultra-wideband device further comprising a transmitter coupled to the switch, the transmitter comprising
 - an encoding unit coupled to a data source, the encoding unit containing circuitry to apply a code to data provided by the data source;
 - a spreading unit coupled to the encoding unit, the spreading unit containing circuitry to apply a spreading code to the data;
 - a pulse shaping unit coupled to the spreading unit, the pulse shaping unit containing circuitry to apply mask of a desired pulse with desired frequency characteristics to the encoded and spread data;

- 1 25. The ultra-wideband transmitter of claim 20, wherein the pulse shaping unit comprises:
2 a sampler to upsample the encoded and spread data by a specified amount; and
3 a filter coupled to the sampler, the filter having a frequency response of the desired pulse.
- 1 26. The ultra-wideband transmitter of claim 25, wherein the filter has the frequency response
2 of a square-root raised cosine (SRRC) pulse.

24 a modulating unit coupled to the pulse shaping unit, the modulating unit to apply
25 a carrier frequency to the shaped, encoded, and spread data; and
26 a filter coupled to the modulating unit and the switch, the filter to ensure that the
27 modulated, shaped, encoded, and spread data fit within a desired frequency range.

1 28. The ultra-wideband device of claim 27, wherein the desired pulse is a square-root raised
2 cosine (SRRC) pulse.

1 29. The ultra-wideband device of claim 28, wherein the SRRC pulse has a frequency
2 bandwidth that is a fraction of available ultra-wideband bandwidth.

1 30. The ultra-wideband device of claim 27, wherein the device avoids transmitting in
2 frequency bands of known interferers.

1 31. The ultra-wideband device of claim 30, wherein the device transmits in the frequency
2 bands of known interferers when they are absent.

1 32. The ultra-wideband device of claim 27, wherein the device transmits in a portion of
2 available ultra-wideband bandwidth, and wherein when multiple ultra-wideband devices are
3 present, each ultra-wideband device can transmit in a different portion of the ultra-wideband
4 bandwidth.